1. An optical component comprising:

a dielectric waveguide extending along a longitudinal axis and having a refractive index cross-section perpendicular to the longitudinal axis, the refractive index cross-section causing the dielectric waveguide to support an electromagnetic (EM) mode having a group velocity that passes from negative values to positive values over a range of non-zero longitudinal wavevectors.

2. The optical component of claim 1, wherein the cross-section of the dielectric waveguide comprises an inner dielectric region and an outer dielectric region surrounding the inner dielectric region, wherein the outer dielectric region substantially confines EM energy of the EM mode within the inner dielectric region and the inner dielectric region includes a higher-index region surrounded by at least one lower-index region.

3. The optical component of claim 2, wherein the higher index region in the inner region is a core including the longitudinal axis of the waveguide.

4. The optical component of claim 2, wherein the outer dielectric region comprises a series of concentric dielectric layers.

5. The optical component of claim 4, wherein the concentric layers alternate between a first layer having a first thickness and a first refractive index and a second layer having a second thickness and a second refractive index different from the first refractive index.

6. The optical component of claim 5, wherein the concentric layers in the outer region form a Bragg reflector.

7. The optical component of claim 6, wherein the Bragg reflector is an omnidirectional Bragg reflector.

8. The optical component of claim 2, wherein the outer dielectric region is a two-dimensionally periodic structure with a photonic bandgap.

9. The optical component of claim 3, wherein the inner dielectric region consists of the core and the one lower-index region surrounding the core.

10. The optical component of claim 3, wherein the inner dielectric region comprises at least two lower-index regions surrounding the core and at least one additional higher-index region separating the lower-index regions.

11. The optical component of claim 10, wherein the refractive index of the core is the same as that of the higher-index region separating the lower-index regions.

12. The optical component of claim 10, wherein the refractive index of the core is different from that of the higher-index region separating the lower-index regions.

13. The optical component of claim 10, wherein the refractive index of the lower-index regions are the same.

14. The optical component of claim 10, wherein the refractive index of the lower-index regions are different.

15. The optical component of claim 10, wherein the thickness of at least one of the lower-index regions differs from that of at least one other of the lower-index regions.

16. The optical component of claim 10, wherein the core has a circular cross-section and the higher-index and lower-index regions are concentric annular regions surrounding the core.

17. The optical component of claim 1, wherein the cross-section is circular.

18. The optical component of claim 1, wherein the cross-section is hexagonal.

19. The optical component of claim 1, wherein the cross-section is rectangular.

20. The optical component of claim 1, wherein the waveguide has a uniform cross-section with respect to the longitudinal axis.

21. The optical component of claim 1, wherein the longitudinal axis is straight.

22. The optical component of claim 1, wherein the longitudinal axis includes a curved portion.

23. The optical component of claim 1, wherein the frequency of the mode at the zero group velocity crossing corresponds to a vacuum wavelength in the range of about 350 nm to about 3 microns.

24. The optical component of claim 2, further comprising a metal layer surrounding the outer region to reduce leakage of the EM energy to the surrounding environment.

25. The optical component of claim 1, further comprising a bias source coupled to the dielectric waveguide, wherein during operation the bias source selectively alters the refractive index of a portion of the waveguide to alter the wavevector corresponding to the zero group velocity crossing.

26. A laser comprising:

the dielectric waveguide of claim 1, wherein the dielectric waveguide includes a gain medium; and

an excitation source coupled to the gain medium, wherein during operation the excitation source causes the gain medium to emit photons at a frequency in the region where the group velocity of the EM mode passes from negative values to positive values.

27. The laser of claim 26, wherein the dielectric waveguide comprises a core aligned with the longitudinal axis and multiple layers surrounding the core.

28. The laser of claim 26, wherein the excitation source is an optical source.

29. The laser of claim 26, wherein the excitation source is an electrical source.

30. The laser of claim 27, wherein the gain medium is dispersed within the core.

31. The laser of claim 27, wherein the gain medium is dispersed within one of the layers.

32. The laser of claim 26, further comprising a bias source coupled to the dielectric waveguide, wherein during operation the bias source selectively alters the refractive index of a portion of the waveguide to alter the wavevector corresponding to the zero group velocity crossing.

33. A nonlinear optical method comprising:

providing the dielectric waveguide of claim 1;

coupling an input optical signal into the dielectric waveguide, wherein the input optical signal is at a frequency in the region where the group velocity of the EM mode passes from negative values to positive values; and

receiving an output optical signal produced by a nonlinear optical interaction between the input signal and the dielectric waveguide.

34. A nonlinear optical switch comprising:

the dielectric waveguide of claim 1;

an input channel configured to couple an input optical signal into the dielectric waveguide, wherein the input optical signal is at a frequency in the region where the group velocity of the EM mode passes from negative values to positive values; and

an output channel configured to receive an output optical signal produced by a nonlinear optical interaction between the input signal and the dielectric waveguide.

35. An optical modulator comprising:

the dielectric waveguide of claim 1; and

a bias source coupled to the dielectric waveguide, wherein during operation the bias source selectively alters the refractive index of a portion of the waveguide to alter the region where the group velocity of the EM mode passes from negative values to positive values.

36. The optical modulator of claim 35, wherein the bias source is an optical bias source.

37. The optical modulator of claim 35, wherein the bias source is an electrical bias source.

38. The modulator of claim 35, wherein the alteration of the refractive index causes the frequency of the zero group velocity crossing to change.

39. The modulator of claim 35, wherein the alteration of the refractive index causes the zero group velocity crossing to disappear.

40. A portion of an optical telecommunications network comprising:

an optical transmission line connecting two nodes of the network; and

the dielectric waveguide of claim 1 coupled to the transmission line between the two nodes, the parameters of the waveguide selected to offset group velocity dispersion introduced by the optical transmission line over a range of frequencies.

41. A dispersion compensation method comprising:

providing the waveguide of claim 1;

coupling an input optical signal into the waveguide to impart group velocity dispersion to the signal, wherein the input optical signal is at a frequency in the region where the group velocity of the EM mode passes from negative values to positive values; and

selecting the amount of group velocity dispersion imparted to the signal based on the parameters of the waveguide.

42. The method of claim 41 further comprising:

applying a bias to the waveguide to change the amount of group velocity dispersion imparted to the signal.

43. An optical system comprising:

at least two optical paths coupled at one end, wherein each path is configured to carry an optical signal; and

the waveguide of claim 1 positioned along one of the paths, wherein during operation the waveguide introduces a time delay to one of the signal when that signal is at a frequency in the region where the group velocity of the EM mode passes from negative values to positives value.

44. An optical time delay method comprising:

providing the waveguide of claim 1; and

delaying an optical signal by directing it through the waveguide, wherein the signal is at a frequency in the region where the group velocity of the EM mode passes from negative values to positive values.